

Selection Guide | VLT® Decentral Drive FCD 302

Putting the control closer to your motors – all you need is in one box

The new generation VLT® Decentral Drive FCD 302

There are times when it makes sound financial sense to get the speed controller closer to the motor.

This is particularly the case with installations of multiple smaller drives, especially on conveyor applications in, for example, the food and beverage industries and materials handling.

With the introduction of the new generation VLT® Decentral Drive FCD 302, Danfoss has raised the bar on the design and functionality of decentral drives.

In installations where multiple motors are spread around a facility such as bottling plants, food preparation and packaging plants and airport baggage

handling installations, there may be dozens, perhaps hundreds, of drives, working together but spread over a large physical area.

In these cases cabling costs alone outweigh the cost of the individual drives and it makes sense to get the control closer to the motors.

The world's first

When Danfoss introduced the world's first production drives over 40 years ago, the early VLT® drive was essentially a decentral drive, suited to installation close to the motor it was driving.

The VLT® drive rapidly found favour in the food and beverage sector, on packaging machinery and conveyors,

simply because it was impervious to the spillage of food or liquids and could easily be washed-down. Some of these early VLT® drives are still in operation today.

Back to the decentral idea

As technology moved forward with the rapid development of semi-conductor switching devices, the cooling need diminished and inverter drives were largely designed for installation in central control rooms, multiple inverters being installed in large control cubicles and cabled out to the drive motors, some very distant.

The wheel has come full circle and Danfoss' 40 years of industry leading experience of drives and advanced



technological development has led back to a high performance decentral format with all the control functionality and performance of larger central drives but now in an IP 66 enclosure especially designed to suit multi-motor applications across a wide spectrum of industry.

Hygienic design required

Especially in food and beverage production areas, but also in pharmaceutical and cosmetic manufacturing plants, hygiene compliance rules in sensitive areas are extremely demanding.

These rules include the specifications and guidelines for the comprehensive, proactive protection of food from contamination with bacteria, fungi and yeasts during processing. The result can be summarized under the heading "Hygienic Design".

Thus, the responsibility for implementing and achieving these targets lies with the machine manufacturers and operators. The

hygienic design of process equipment and components should be based on a sound combination of process and mechanical engineering as well as knowledge in microbiology.

Danfoss has adopted hygienic requirements at the initial stage in developing its drives because upgrading of existing process equipment designs to meet hygienic requirements is often both expensive and unsuccessful.



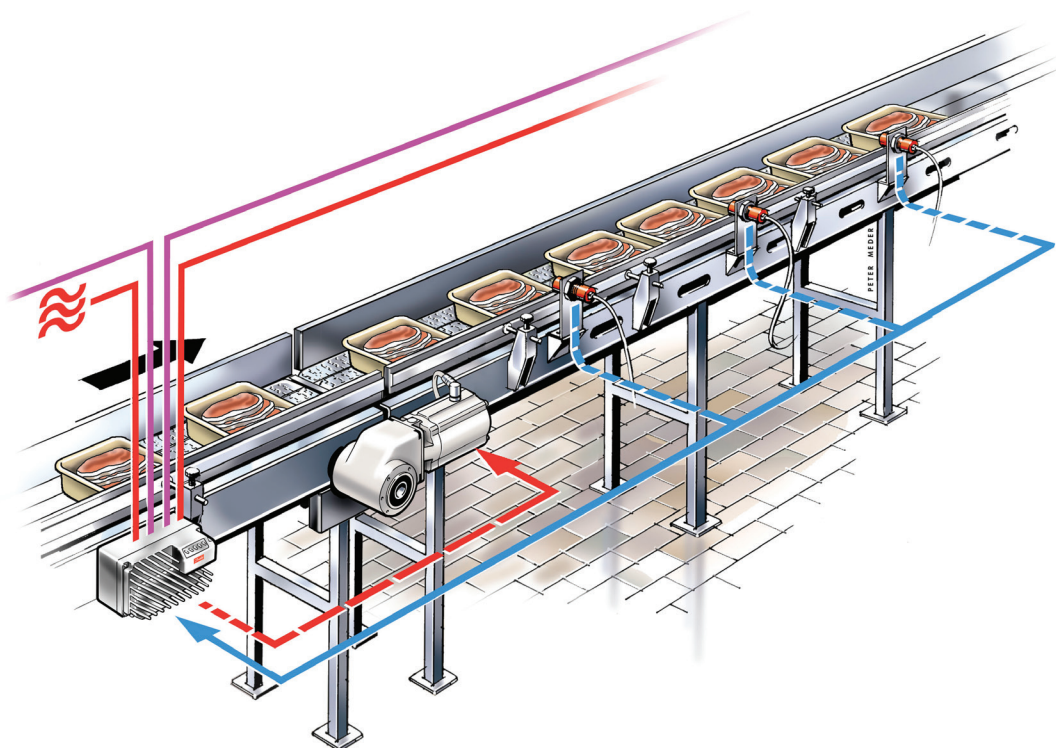
New hygienic trends

EU regulations for the compliance of hygienic equipment to be used in the manufacturing of popular food and beverages are becoming increasingly tight. For example, in the beverage industry, still water, fruit juices and alcohol free beers are all highly reactive to external influences.

New packaging materials also raise the demands on the hygienic conditions. Plastic packaging for cosmetics, including PET bottles in the drinks industry, require new measures as they do not tolerate heat sterilization or cleaning that previously rendered glass containers aseptic.



Decentral can be less costly than centralized drive installations



This latest generation VLT® Decentral Drive FCD 302 has been designed with simplicity and robustness in mind and offers significant advantages for multi-motor installations by mounting the drives close to the motors.

One box concept minimizes design and installation costs

Unlike some decentral drive solutions, VLT® Decentral Drive FCD 302 is a true 'one box' solution based on the same reliable platform as the original VLT® AutomationDrive.

Design and installation costs can be dramatically reduced. No need for field distribution or drop-down boxes and no external 24 V DC supply is required.

For the OEM it's a breeze – fewer boxes to be mounted in fewer positions and fewer connections and terminations so that labour costs are significantly reduced.

Commissioning time and costs reduced

By choosing decentral drives, the OEM can deliver the whole conveying system ex-factory, pre-wired and pre-tested, saving valuable commissioning time after installation. It eliminates the need for expensive expert staff on-site to mount and test; simply connect the power and fieldbus cables and you're good to go.

Built-in distributed I/O system

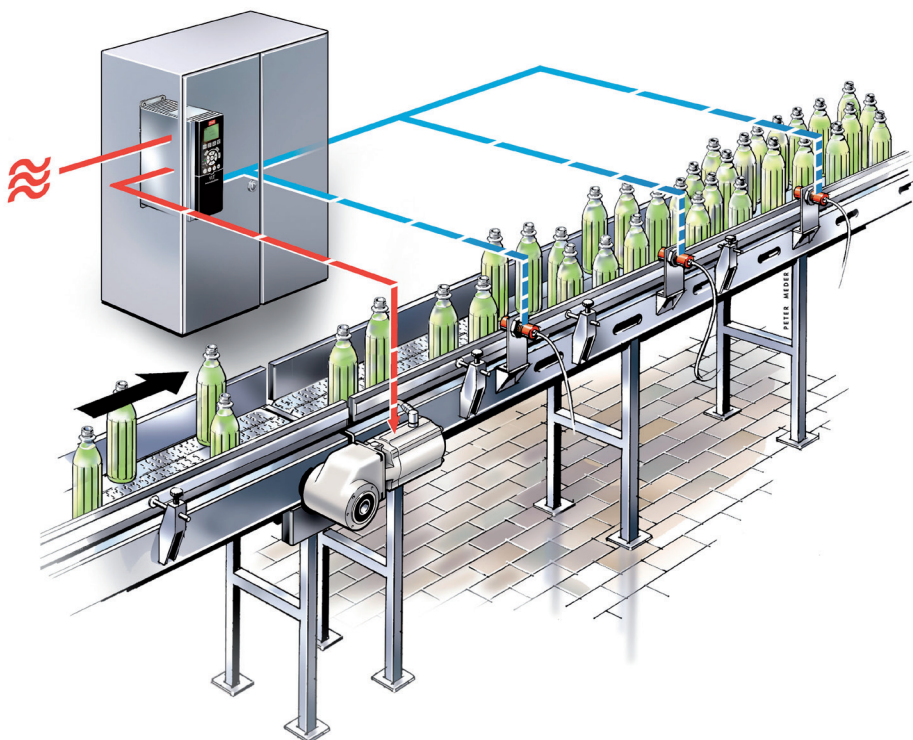
The modular design allows all the sensors and actuators on each conveyor module (e.g. proximity sensors and solenoid valves) to be connected to the high speed digital I/O of the FCD 302. All drives can be connected to the PLC via a high speed fieldbus – saving the cost of a distributed I/O system, thus the necessary wiring on-site will be reduced to just connecting the power cables and the fieldbus cables.

Cutting control room costs

Control room space comes at a premium and by mounting the drive inverters close to their motors, the need

**Up to 40%
cost savings**

Statement from machine builders, claiming savings of up to 40% on the machine/equipment design by switching to the decentral concept - depending on plant layout and drive concept.



for a designated control room and expensive control cubicles is largely eliminated, representing a substantial cost saving in first-cost terms.

Power cabling costs reduced

Even greater savings are offered by the reduction in cabling costs, taking advantage of the loop-in, loop-out mains cabling using unscreened cables.

Installing the drives closer to their motors eliminates the need for long and costly screened cables from the drive to the motor.

Control cabling simplified

Serial communications and field-bus options also simplify and cost-reduce control wiring installation and allow central control of the entire system.

Hygienic design

After years working with the food and beverage industry, Danfoss knows better than most the need for a robust, watertight construction that can be cleaned down quickly and easily, shortening the maintenance window.

Increased uptime

Decentral drives are by far the fastest to fault-find on. Any drive trip can quickly and accurately be isolated to a particular drive unit.

The modular twin-part design of the FCD 302 means that any faulty item can be replaced swiftly by unskilled personnel. Spare part inventory costs are significantly reduced since only two different spare drives are sufficient to cover all power sizes.

High dynamic performance

FCD 302's advanced vector control strategy allows it to be used with compact, efficient, high-performance permanent-magnet motors as well as asynchronous motors, without the need for an encoder. One drive – right across the site.



Two versions

The VLT® Decentral Drive FCD 302 is offered in two versions in order to perfectly match the requirements in the different production environments, from dry areas to wash-down and even hygienic.

Where Decentral Drives succeed

Food & Beverage Industry



Beverage conveyors

In a modern beverage plant, conveyor systems can run to many kilometres of total length.

Smooth control is essential as is the maintenance of a sterile environment, often necessitating daily wash-downs.

The IP 66 drive enclosures can be washed down with power hoses and aggressive cleaning solutions.

Beer, soft drinks – no problem to the FCD 302.

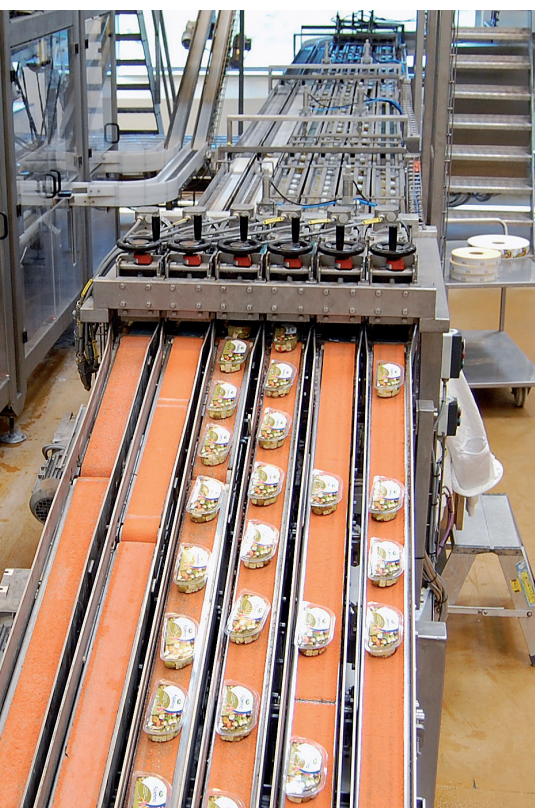
Case and pallet conveyors

The end of production lines in the food and beverage industry is universally equipped with case and pallet conveyors.

At the far end of the production line, it might physically be some distance from the main electrical switch-room and cable runs to the various motors will be lengthy and costly.

The VLT® Decentral Drive FCD 302 changes all that. Every motor can be controlled by an FCD 302 mounted near to it and with the FCD's loop in/out cable methodology, cable runs minimized and cost-reduced.

Maintenance is simplified since individual drives are easily identified and repairs speedily effected by the fast module swap-over design.



Food conveyors

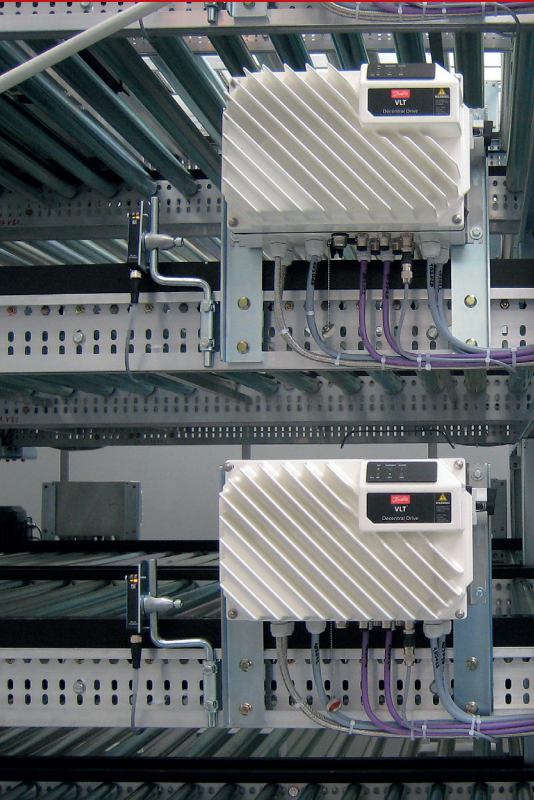
In food production areas where the product may come into direct contact with equipment and motors, the hygienic design of process equipment has a tremendous impact on diminishing the risks of contamination, which also means that the shelf life of products is improved. If the applied process equipment is of a poor hygienic design, it is difficult to clean it of micro- bacterial contamination.

The VLT® Decentral Drive FCD 302 is designed without crevices and without openings for dirt and micro-organisms, its smooth and easy to clean surface and the stainless steel connectors comply with the hygienic requirements

in food production areas and deliver food safety in your production.

Besides this, the FCD 302 lends itself perfectly to food conveyors cost-effectively by simplifying the cable installation and thus reducing the cabling costs.

Material Handling Industry



Conveyors

The VLT® Decentral Drive FCD 302 might well have been designed especially for material handling schemes, so perfectly does it meet the demands of the application.

Large numbers of small drives, spread over a large physical area, do not lend themselves well to a central drives control room and long cable runs from the drives to the motors can be costly, and troublesome unless additional chokes and filters are fitted, at significant extra cost.

With FCD 302, no additional chokes and filters are required and cable costs are greatly reduced since the drives and motors are only a few centimetres away from each other.

For the same reason, the RFI signature is even meeting category 2/A1 – first environment requirements and less prone interfere with sensitive equipment.



Sorter systems

Sorter systems demand fast response of the drives powering them and the high dynamic performance of the VLT® Decentral Drive FCD 302 suits this application perfectly.

Here again the installation might well spread over a significant physical area and not be suited to large numbers of drives installed in a central control room, making them less easy to identify individually and concentrating a good deal of heat in the control room, necessitating auxiliary cooling systems.

With the FCD 302s located next to their motors, cabling is minimized, identification is simplified and heat dissipation is spread over a large area, and in winter, contributes to the overall heating, reducing heating costs.

FCD 302 – the One Box Concept reduces your Total Cost of Ownership

Total Cost of Ownership, TCO, is a primary focus in the decision making process when buying complex technical equipment. A lower first cost is no longer the smart way to buy. The price has to be sensible, but alongside the price there are a whole host of factors that influence the overall cost of the equipment during its lifetime. Those factors, from the costs of ordering, through to the running and maintenance costs, can combine to total more than the original purchase price, turning a cheap buy into a very costly ownership.

The all new VLT® Decentral Drive FCD 302 completes the transition of the VLT® drive to a true One Box Concept with the lowest Total Cost of Ownership (TCO).

It's really that simple – everything needed to control the motor is contained within the IP 66 drive enclosure. Just loop the mains cable into the box, and out to the next box, connect a cable to the motor and you're ready to run. Add a high speed fieldbus cable and your drives are an integral part of the whole drives control network. No need for an external 24 V DC power supply, no need for an external controller or motor switch – it's all in the FCD 302.

Every aspect of the FCD 302 contributes to the lowest TCO.

Its unique design is intended to simplify ordering, installation, commissioning, operation and maintenance.

Performance and operation

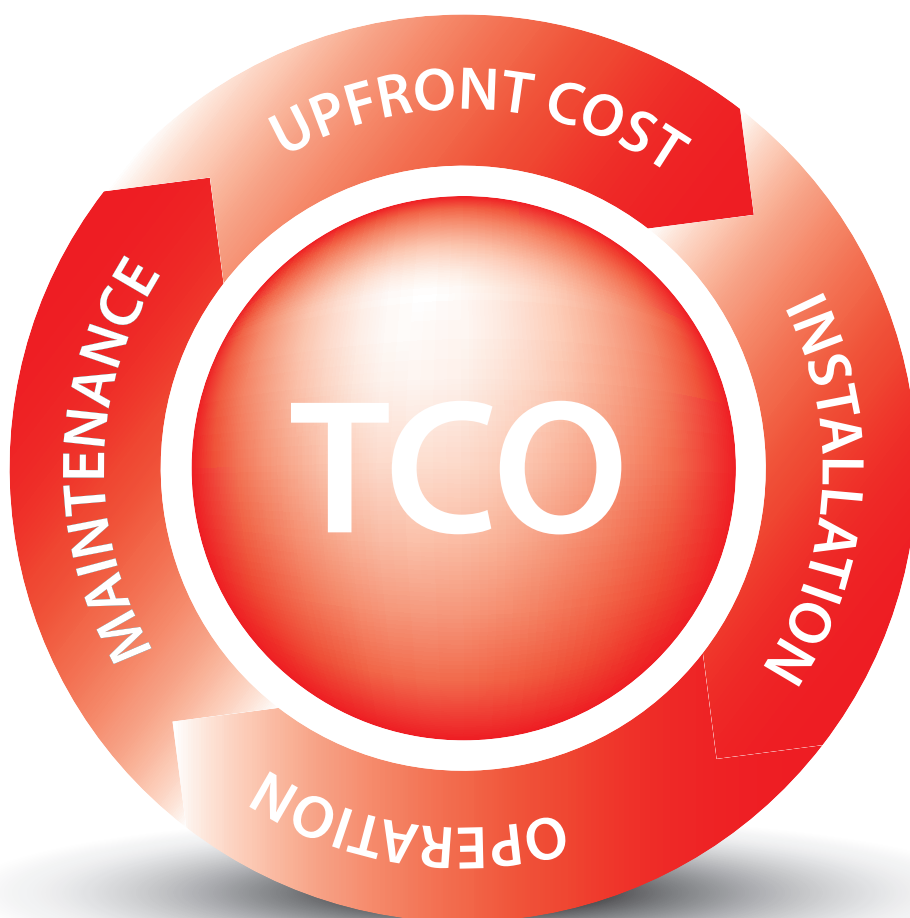
In performance and operation terms, the FCD 302 shares a common platform with the Danfoss VLT® AutomationDrive range, meaning there's no new learning involved and less time spent discussing the application with Danfoss' drives specialists.

Documentation and parts

There's less documentation and fewer parts and no need for field distribution or drop-down boxes and it's a global product design with local approvals and documentation available in a wide selection of languages.

Simple interface

There's a clear interface between the installation box and the control section. That means just one drawing detailing the electric assembly/installation box.



Order handling

Ordering is simplified by the limited number of ordering lines required. This means there is less maintenance of purchasing orders and reduced risk of ordering the wrong parts – or missing parts altogether.

At incoming goods there are fewer parts to check-in so less time taken to compare delivery to original order, less risk of missing parts, fewer inventory locations and less space required for storage.

Installation

With fewer numbers of boxes to be mounted, in fewer locations, that's a saving in time and man-hours. Fewer cables cut time and cost and less money spent on cable management systems. No external 24 V DC supply is required so that's another cable less and the cost of a central dc power supply out of the equation. Fewer connections and terminations also reduces labour cost at installation and lowers the likelihood of failure due to poor or wrong connectivity.

Commissioning

The One Box Concept means that commissioning time is significantly reduced. A multi-lingual graphical display with on-board manual means no lost time searching for the manual. The HMI (human machine interface), based upon the award winning VLT® display, has a customized display to display just the parameters you decide are important to you.

The FCD 302 also makes use of the VLT® Motion Control Tool MCT 10, proven in use in the field with thousands of VLT® drives. Programmes can be stored and shared, drive to drive; OEMs can pre-commission drives prior to despatch, making for faster

commissioning of the completed installation on-site. Flexible PC connection through USB, RS485 and HPFP and a capability facilitate programme is available as download via internet to update the OEM's factory settings at the end-user's plant, which simplifies and reduces cost of commissioning.

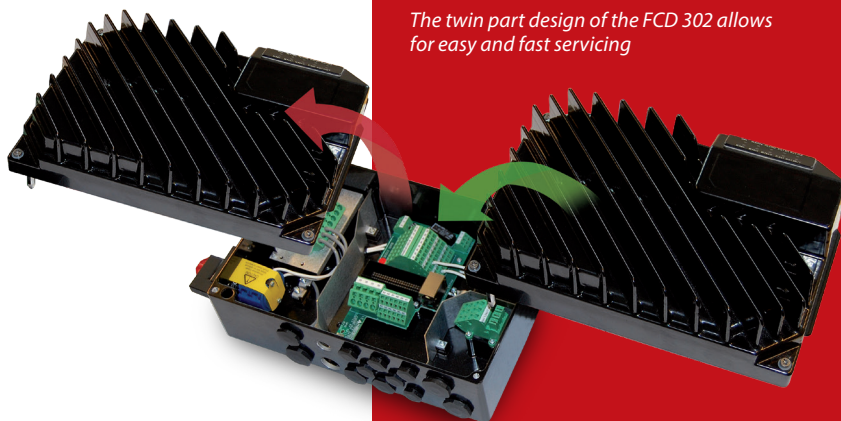
Service

The FCD 302 is probably the simplest and easiest drive to service which Danfoss has ever developed. Self-diagnostic troubleshooting combined with an on-board manual accessed through the graphical display makes faultfinding and troubleshooting easy. All alarms and operations are logged in the memory for easy access and interpretation of past events.

The twin part design dramatically reduces the time necessary to locate any failure area and replace the failed part, minimising downtime. The failed part can be replaced by untrained personnel and spares inventory is dramatically reduced. No longer shelves loaded with vulnerable printed circuit boards (and never the right one available). Just two parts – a top and a bottom to make service fast and reliable.



Six LEDs indicate the current device status – for further programming and configuration a graphical control panel identical to the displays of the FC-series can be connected from the outside.



The twin part design of the FCD 302 allows for easy and fast servicing

FCD 302 – the One Box Concept

All you need is in one box

Integrated 24 V supply

24 V DC control supply is provided by the drive supplying remote I/Os distribution.

Power looping

The new FCD 302 facilitates internal power looping. Terminals for 6 mm² (big box) or 4 mm² (small box) power cable inside the enclosure allows connection of multiple units in the same branch.

Ethernet switch

Integrated Ethernet switch/ hub with the two RJ-45 ports are available in the drive for easy daisy-chaining of Ethernet communication.

Fieldbuses are routed easily, without adding commissioning time, by connecting Ethernet or Profibus based field buses to a M12 pluggable interface.

PROFIBUS communication

Straight and easy access to the spring-loaded terminals for daisy-chaining.

Decentral I/O

Connection of all input/output devices is via IP 67 rated M12 connectors on the FCD 302.

Control terminals

Specially developed spring-loaded cage clamps enhance reliability and facilitate easy commissioning and service.

EMC and Network effects

The VLT® Decentral Drive complies as standard with EMC limits A1 according to the EN 55011 norm.

The standard integrated DC coils also ensure low harmonic load on the network according to EN 61000-3-12 and increase the lifespan of the drive.

Display connection

The same award-winning Local Control Panel as for FC-drives, can also be used with the FCD 302. Connection can be made from the outside, without the need for opening the box, through the built-in LCP plug.

The info button makes the printed manual virtually redundant. The Automatic Motor Adaptation, Quick Set-Up menu and large graphic display make commissioning and operation a breeze.

Built-in Smart Logic Controller

The Smart Logic Controller is a simple but clever way to keep your drive, motor and application working together. The controller monitors a specified event. When an event occurs, the controller triggers a specified act and starts monitoring the next event continuing for up to 20 steps before returning to step one.

Safety

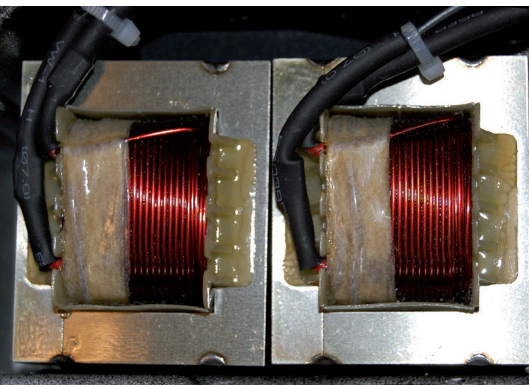
The drive is delivered as standard with the Safe Torque Off (Safe Stop) function in compliance with EN ISO 13849-1 Category 3 PL d and SIL 2 according to IEC 61508 low demand and high demand mode.

This feature prevents the drive from starting unintentionally. Enhanced safety features are available as options.

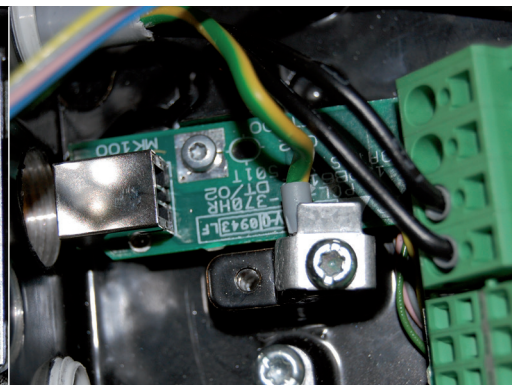
PC-software

The drive can also be commissioned via the built-in USB/RS485 connection or a fieldbus from the VLT® Motion Control Tool MCT 10. Access to the USB-port is made from the outside, without the need for opening the box, just by removing the cap on the dedicated hole.

Built-in DC coils to limit harmonic distortion

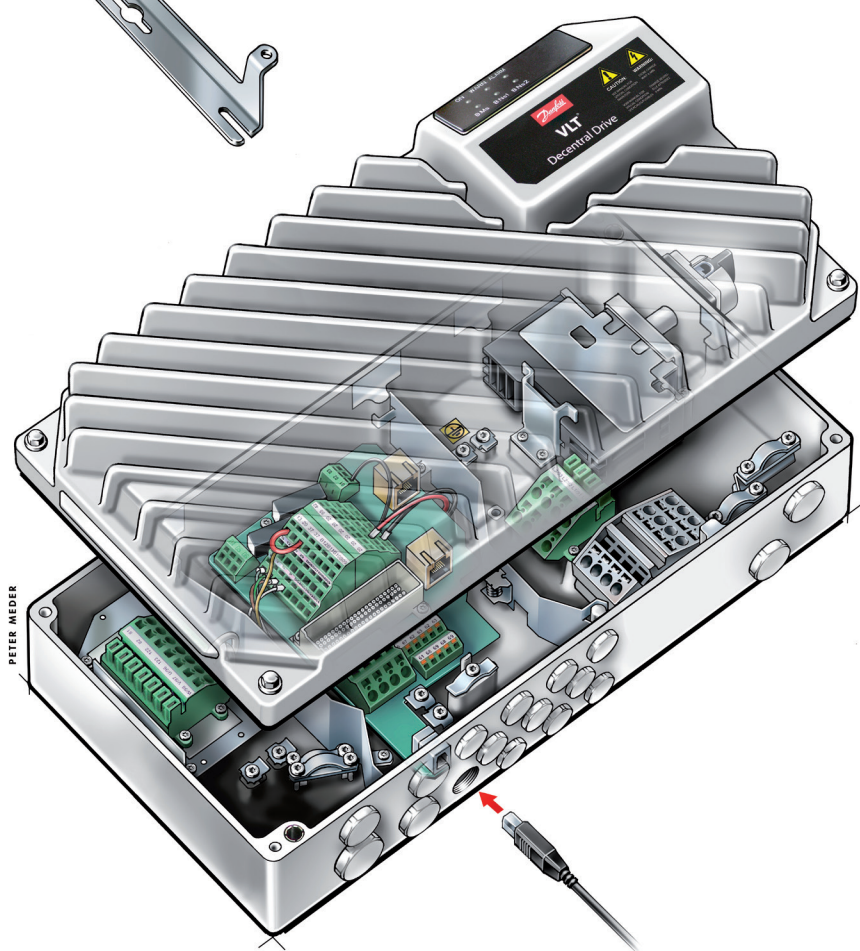
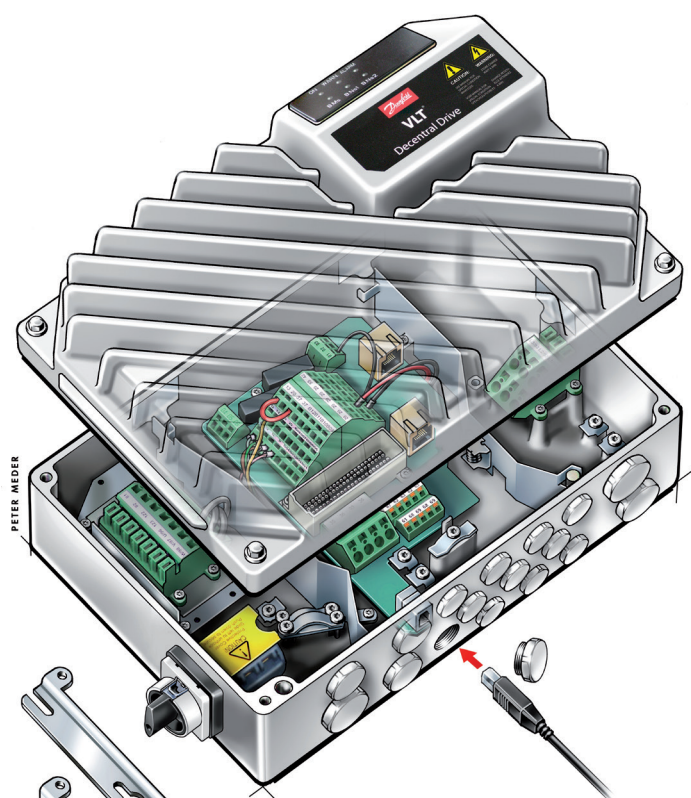


Easy accessible terminals for internal looping



Easy access for PC software connection

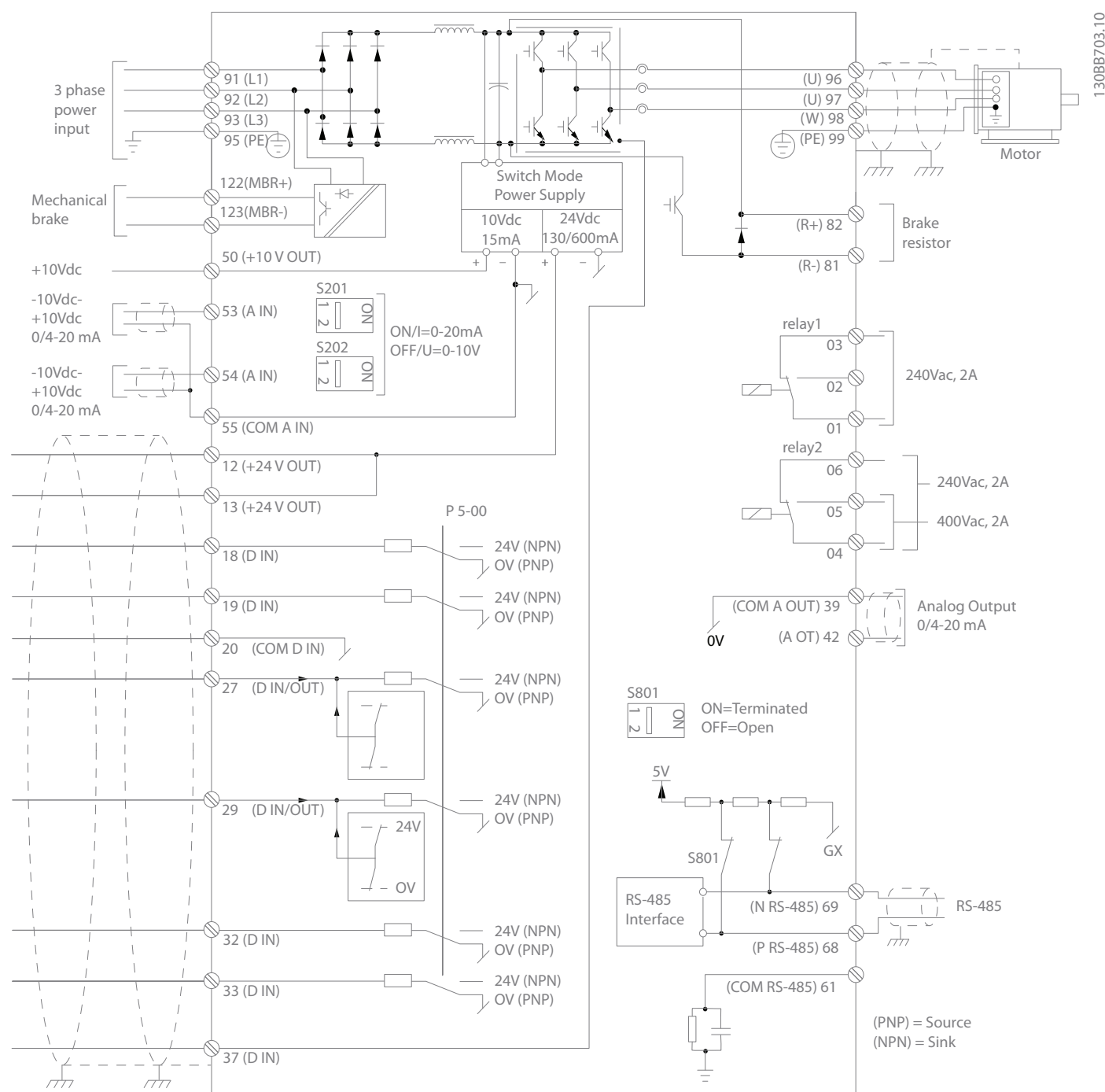




Two dimensions

The VLT® Decentral Drive FCD 302 is available in two enclosure sizes.

Connection examples



The diagram shows the port terminals of the FCD 302. Additional options will expand the number of terminals. The numbers indicated refer to the terminal numbers of the drives.

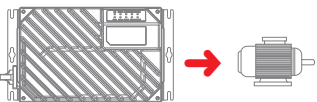
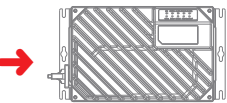
Users can set the mode of the analogue inputs 53 and 54 by using the S201 and S202 switches.

The FCD 302 has a RS485 and an USB interface as standard. The RS485 terminations are integrated in the drive

(S801). The drive can be equipped with a fieldbus option if necessary.
To switch from NPN to PNP logic for the digital signals, use parameter 5-00.

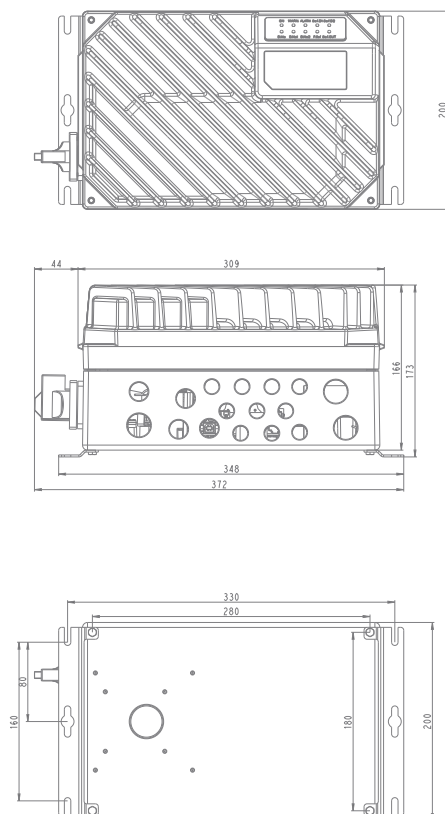
Power and currents

Mains Supply 3 x 380 – 480 VAC

AC drive		PK37	PK55	PK75	P1K1	P1K5	P2K2	P3K0	
Typical Shaft Output [kW]		0.37	0.55	0.75	1.1	1.5	2.2	3.0	
Typical Shaft Output [HP] at 460 V		0.5	0.75	1.0	1.5	2.0	3.0	4.0	
Output current									
	Continuous (3 x 380-440 V) [A]	1.3	1.8	2.4	3.0	4.1	5.2	7.2	
	Intermittent (3 x 380-440 V) [A]	2.1	2.9	3.8	4.8	6.6	8.3	11.5	
	Continuous (3 x 441-480 V) [A]	1.2	1.6	2.1	3.0	3.4	4.8	6.3	
	Intermittent (3 x 441-480 V) [A]	1.9	2.6	3.4	4.8	5.4	7.7	10.1	
	Continuous kVA (400 V AC) [kVA]	0.9	1.3	1.7	2.1	2.8	3.9	5.0	
	Continuous kVA (460 V AC) [kVA]	0.9	1.3	1.7	2.4	2.7	3.8	5.0	
Max. cable size: (mains, motor, brake) [mm²/ AWG]		4/11						6/10	
Max. input current									
	Continuous (3 x 380-440 V) [A]	1.2	1.6	2.2	2.7	3.7	5.0	6.5	
	Intermittent (3 x 380-440 V) [A]	1.9	2.6	3.5	4.3	5.9	8.0	10.4	
	Continuous (3 x 441-480 V) [A]	1.0	1.4	1.9	2.7	3.1	4.3	5.7	
	Intermittent (3 x 441-480 V) [A]	1.6	2.2	3.0	4.3	5.0	6.9	9.1	
	Recommended fuse size	gG-10						gG-16	
	Recommended max. pre-fuses IEC/UL [A]	gG-25							
	Recommended circuit breaker (small box)	CTI-45MB							
	Recommended circuit breaker (big box)	CTI-25M 047b3151							
	Power loss at max. load [W]	35	42	46	58	62	88	116	
	Efficiency	0.93	0.95	0.96	0.96	0.97	0.97	0.97	
Weight [kg] (small box)		9.8						X	
Weight [kg] (big box)		12.9							

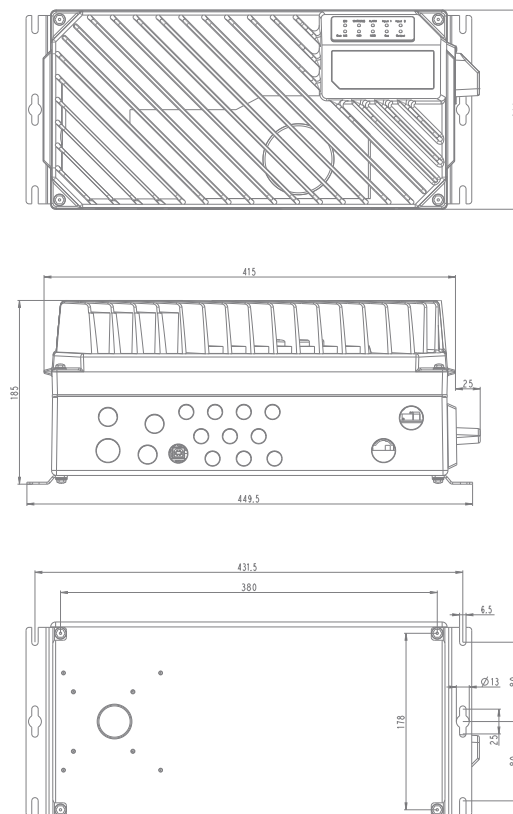
Dimensions

Small enclosure size (0.37 – 2.2 kW/0.5 – 3.0 HP)



All measurements are in mm

Large enclosure size (0.37 – 3 kW/0.5 – 4.0 HP)



Ordering type code for FCD 302

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	
Fixed	F	C	D	3	0	2	P				T	4				H	1												X	A		B		X	X	X	X	X	D	
Variants								K	3	7			B	6	6			X	1	X	X	X	C	X	X	X	X		X		X								X	
								K	5	5			W	6	6			S	3	E	M	E		E			E		0		R							0		
								K	7	5			W	6	9				X	F	N	F		F			P		N		U									
								1	K	1									Y		O	S							L		Z									
								1	K	5									R				M						8											
								2	K	2									T				L						Y											
								3	K	0													K																	
								X	X	X																														

[01-03]	Product group
FCD	VLT® Decentral Drive FCD 302

[04-06]	AC drive series
302	VLT® Decentral Drive

[07-10]	Power size
PK37	0.37 kW / 0.5 HP
PK55	0.55 kW / 0.75 HP
PK75	0.75 kW / 1.0 HP
P1K1	1.1 kW / 1.5 HP
P1K5	1.5 kW / 2.0 HP
P2K2	2.2 kW / 3.0 HP
P3K0	3.0 kW / 4.0 HP
PXXX	Installation box only (without power section)

[11-12]	Phases, mains voltage
T	Three phase
4	380 – 480 V

[13-15]	Enclosure
B66	Standard Black – IP 66/NEMA 4X
W66	Standard White – IP 66/NEMA 4X
W69	Hygienic White – IP 66/NEMA 4X

[16-17]	RFI filter
H1	RFI filter class A1/C2

[18]	Brake
X	No brake
S	Brake + mechanical brake supply

[19]	Hardware configuration
1	Complete product, small enclosure, stand alone mount
3	Complete product, large enclosure, stand alone mount
X	Drive part, small enclosure (No installation box)
Y	Drive part, large enclosure (No installation box)
R	Installation box, small enclosure, stand alone mount (No drive part)
T	Installation box, large enclosure, stand alone mount (No drive part)

[20]	Brackets
X	No brackets
E	Flat brackets
F	40 mm brackets

[21]	Threads type
X	No installation box
M	Metric threads
N	NPT variant1
O	NPT variant2

[22]	Switch option
X	No switch option
E	Service switch on mains input
F	Service switch on motor output
S	small circuit braker
M	medium circuit braker
L	large circuit braker
K	Service switch on mains input with additional looping terminals (large enclosure only)

[23]	Display
C	With display connector

[24]	Sensor plugs
X	No sensor plugs
E	Direct mount 4xM12
F	Direct mount 6xM12

[25]	Motor plug
X	No motor plug

[26]	Mains plug
X	No mains plug

[27]	Fieldbus plug
X	No fieldbus plug
E	M12 Ethernet
P	M12 Profibus

[28]	Reserved
X	

[29-30]	A option
AX	No A option
A0	PROFIBUS DP
AN	EtherNet/IP
AL	PROFINET
A8	EtherCAT
AY	POWERLINK

[31-32]	B option
BX	No B option
BR	VLT® Encoder Input MCB 102
BU	VLT® Resolver Input MCB 103
BZ	VLT® Safe PLC I/O MCB 108

[33-37]	Reserved
XXXXX	

[38-39]	D option
DX	No D option
D0	24 V DC back-up input

NOTE: For availability of specific options and configurations please refer to drive configurator at <http://driveconfig.danfoss.com>

Options and Specifications

Fieldbus options

(integrated into the control card)

- PROFIBUS DP
- PROFINET
- EtherNet/IP
- EtherCAT
- POWERLINK

Hardware options

- Mounting brackets
- Service switch
- Internal circuit breaker
- M12 sensor plugs
- 24 V DC input for control supply
- Brake chopper
- Electromechanical brake control and supply
- Fieldbus plugs

Application options

- VLT® Encoder Input MCB 102
- VLT® Resolver Input MCB 103
- VLT® Safe PLC I/O MCB 108

Mains supply (L1, L2, L3)	
Supply voltage	380 – 480 V ±10%
Supply frequency	50/60 Hz
True Power Factor (λ)	0.92 nominal at rated load
Displacement Power Factor ($\cos \phi$)	(>0.98)
Switching on input supply	2 times/min.

Output data (U, V, W)	
Output voltage	0 – 100% of supply
Output frequency	0 – 590 Hz 0 – 300 Hz (Flux mode)
Switching on output	Unlimited
Ramp times	0.01 – 3600 sec.

Digital inputs	
Programmable digital inputs	4 (6)
Logic	PNP or NPN
Voltage level	0 – 24 V DC

Note: One/two digital inputs can be programmed as digital outputs

Analogue inputs	
Number of analogue inputs	2
Modes	Voltage or current
Voltage level	-10 to +10 V (scaleable)
Current level	0/4 – 20 mA (scaleable)

Pulse/encoder inputs	
Programmable pulse/encoder inputs	2
Voltage level	0 – 24 V DC (PNP positive logic)

Digital output	
Programmable digital/pulse outputs	2
Voltage level at digital/frequency output	0 – 24 V

Analogue output	
Programmable analogue outputs	1
Current range	0/4 – 20 mA

Relay outputs	
Programmable relay outputs	2

Integrated 24 V supply	
Max. load	600 mA

Accessories	Description	Ordering no.
Mounting brackets extended	40 mm brackets	130B5771
Mounting brackets	Flat brackets	130B5772
LCP cable	Preconfectioned cable to be used between inverter and LCP	130B5776
Brake resistor 1750 ohm 10 W/100%	For mounting inside installation box below motor terminals	130B5778
Brake resistor 350 ohm 10 W/100%	For mounting inside installation box below motor terminals	130B5780
VLT® Control Panel LCP 102	Graphical display for programming and read out	130B1078
Venting membrane, goretex	Preventing condensation inside enclosure	175N2116
PE termination, M16/20	Stainless steel	175N2703
Spare parts	Description	Ordering no.
Protection cover	Plastic protection cover for inverter part (small box/ large box)	130B5770/130B5789
Gasket	Gasket between installation box and inverter part (small box/ large box)	130B5773/130B5790
Accessory bag	Spare cable clamps and screws for shield termination	130B5774
Service switch	Spare switch for mains or motor disconnect	130B5775
LCP plug	Spare plug for mounting in installation box	130B5777
Main termination board	For mounting in installation box	130B5779
M12 sensor plugs	Set of two M12 sensor plugs for mounting in cable gland hole	130B5411
Control card	Control card with 24 V backup	130B5783
Control card PROFIBUS	Control card Profibus with 24 V backup	130B5781
Control card EtherNet	Control card Ethernet with 24 V backup	130B5788
Control card PROFINET	Control card Profinet with 24 V backup	130B5794
Control card EtherCAT	Control card Ethernet with 24 V backup	130B7124
Control card POWERLINK	Control card POWERLINK with 24 V backup	130B7125



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You will find it easy to do business with us. Online, and locally in more than 50 countries, our experts are never far away, reacting fast when you need them.

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